

Appl. No. 10/650,504
Amdt. Dated June 30, 2008
Reply to Office Action of April 30, 2008

Attorney Docket No. 81872.0052
Customer No. 26021

REMARKS/ARGUMENTS:

Claims 13, 20, and 24 are amended. Support for the amendments to claims 13 and 20 can be found at p. 12, lines 20-21 of Applicant's specification. Claims 13, 14, 20, 21, and 24-26 are pending in the application. Reexamination and reconsideration of the application, as amended, are respectfully requested.

The present invention relates to a dry etching apparatus, a dry etching method, and a plate and a tray used therein, and more particularly to a dry etching apparatus and a dry etching method suitable for use in texturing the surface of a silicon solar cell substrate or the like, and to a plate and a tray used therein. (Applicant's specification, at p. 1, lines 9-14).

INTERVIEW SUMMARY:

On June 26, 2008, Patent Agent Barry Shuman conducted a telephone interview with Examiner Anita K. Alanko. During the interview the parties discussed the comments regarding the information disclosure statement that were in the Final Office Action dated April 30, 2008. The Examiner indicated that she would initial (in the next Office Action) the references for which there was at least a translation of the English abstract.

Applicant would like to thank Examiner Anita K. Alanko for the courtesy of granting a telephone interview with Patent Agent Barry Shuman.

CLAIM REJECTIONS UNDER 35 U.S.C. § 103:

Claims 13 and 14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Marciniak (U.S. Patent No. 3,982,976) in view of Cain (U.S. Patent No. 5,503,881). Applicant respectfully traverses this rejection. Claim 13, as amended, is as follows:

A method for producing a solar cell, comprising:
placing a substrate for a solar cell on an electrode inside a chamber;
covering said substrate with a plate, wherein said plate is provided with a number of opening portions;
forming textures on a surface of the substrate by using residues generated during etching and being chiefly composed of components of the substrate as an etching mask, wherein a distance between said substrate and a surface of said plate opposing said substrate in a peripheral portion of said plate is set shorter than a distance between said substrate and said surface opposing said substrate in a central portion of said plate; and then
removing the residues on the surface of the substrate.

Applicant respectfully submits that the cited references cannot render claim 13 obvious, because the cited references fail to teach or suggest "forming textures on a surface of the substrate by using residues generated during etching and being chiefly composed of components of the substrate as an etching mask, wherein a distance between said substrate and a surface of said plate opposing said substrate in a peripheral portion of said plate is set shorter than a distance between said substrate and said surface opposing said substrate in a central portion of said plate; and then removing the residues on the surface of the substrate."

The Office at p. 3, lines 10-14 of the Office Action states,

"It would have been obvious to use a plate as taught by Cain in the method of Marciniac because Cain teaches that it improves process uniformity. The modified method of Marciniac inherently forms textures by residues composed of substrate material (silicon) since by-products are trapped by the plate and form on the substrate to at least some degree, contributing to surface texturing as cited."

Applicant respectfully disagrees. Marciniac teaches a visual inspection method of forming texture for a pattern of contaminants and residues on a surface of silicon wafer. (Marciniac, Abstract). If Marciniac's method is applied to Cain's plate, a recess is formed at a region where no contaminants and residues exist with etching residue that is chiefly composed of components of the substrate, thereby causing the accuracy of evaluation to be lower, or making it impossible to set an evaluation itself.

Therefore, it is contrary to the object of Marciniac's invention to apply Cain's plate to the method of Marciniac. Therefore, the prior art teaches away from the present invention.

Furthermore, the proposed modification of Marciniac would render Marciniac unsatisfactory for its intended purpose. The MPEP at 2143.01(V) states,

"If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification."

The Office at p. 7, lines 6-10 of the Office Action states,

"Applicant argues that the contaminants and residues of Marciniac do not correspond to components of the substrate. In response, while some residues of Marciniac do not correspond to the components, others do correspond, since as discussed above in the rejection it is inherent that residues form during the etching process. In addition, Marciniac has not removed them by some other process, so they are expected to remain."

Applicant agrees with the Office's interpretation of Marciniac; and Applicant notes that this interpretation is supported at column 3, lines 46-48 of Marciniac which states,

"It should be noted that subjecting a wafer to the reactive plasma hereof, renders such wafer unusable for further processing, at least as to I.C. manufacture." (column 3, lines 46 to 48).

Marciniec's method evaluates contaminants and residues that remain on a surface of silicon wafer; and therefore, Marciniec does not teach a process to remove the etching residue that is chiefly composed of components of the substrate that remains on the surface of the silicon wafer on which a recess is formed.

Consequently, Marciniec does not require the limitation "removing the residues on the surface of the substrate" as recited in amended claims 13 and 20.

In the present invention, textures on a substrate for a solar cell are made by using, and then a solar cell is produced by the substrate. Therefore, claims 13 and 20, as amended, require a process of removing the residues on the surface of the substrate. This process represses a reflection that would be caused when the residues remain on the substrate, and consequently improves the device characteristics of the produced solar cell.

In light of the foregoing, Applicant respectfully submits that the cited references cannot render claim 13 obvious, because the combination of references fails to teach or suggest each and every claim limitation. Claim 14 depends from claim 13 and cannot be rendered obvious for at least the same reasons as claim 13. Withdrawal of this rejection is thus respectfully requested.

Claims 20, 21, 25, and 26 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Marciniec in view of Nishibayashi et al. (U.S. Patent No. 5,417,798) or Gut (U.S. Patent No. 4,810,322). Applicant respectfully traverses this rejection.

Claim 20, as amended, requires "forming textures on a surface of said substrate using residues generated during etching and being chiefly composed of components of the substrate as an etching mask, wherein said plate is provided with a protruding wall on a surface opposing said substrate and said protruding wall is separated from a nearest surface of said substrate by a space; and then removing the residues on the surface of the substrate"; and is therefore, patentable

over Marciniac for reasons discussed above.

Nishibayashi and Gut cannot remedy the defect of Marciniac and are not relied upon by the Office for such. Instead, the Office cites Nishibayashi for teaching a dry etching method comprising: placing a substrate 8 to be etched inside a chamber 1 (Fig.5); and covering said substrate to be etched with a plate 9 provided with a number of opening portions (col.5, lines 20-21), wherein a protruding wall 30 is provided to said plate on a surface opposing said substrate to be etched and said protruding wall is separated from a nearest surface of said substrate by a gap; and an advantage of using the plate with a protruding wall is that it enables the control of the energies or momenta of ions (col.2, lines 35-37). And the Office cites Gut for teaching a method comprising: placing a substrate 22 to be etched on an electrode 16 inside a chamber 12 (Fig. 1); covering said substrate to be etched with a plate (shown in Fig.2) provided with a number of openings 32, 34; wherein a protruding wall ("protrusion" col.4, lines 46-47) is provided to said plate on a surface opposing said substrate to be etched and said protruding wall is separated from a nearest surface of said substrate by a space (inherent since it extends from the plate 30 toward the bottom plate); and that the advantage of using a protrusion is that it enables etch rate uniformity (col.4, line 55).

In light of the foregoing, Applicant respectfully submits that the cited references cannot render claim 20 obvious, because the combination of references fails to teach or suggest each and every claim limitation. Claims 21, 25, and 26 from claim 20 and cannot be rendered obvious for at least the same reasons as claim 20. Withdrawal of this rejection is thus respectfully requested.

ALLOWABLE SUBJECT MATTER:

The Office objected to claim 24 as being dependent upon a rejected base claim but states that this claim would be allowable if rewritten in independent form

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including all of the limitations of the base claim and any intervening claims. In response, Applicant rewrote claim 24 in the manner suggested by the Office. Withdrawal of this objection and allowance of claim 24 is thus respectfully requested.

DOUBLE PATENTING:

Claims 13, 14, 20, 21, and 24-26 stand provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims of copending Application Nos. 10/650,505 and 10/648,429. In response, Applicant files concurrently herewith a terminal disclaimer in compliance with 37 CFR 1.321(c). Withdrawal of this rejection is thus respectfully requested.

Applicant believes the foregoing amendments comply with requirements of form and thus may be admitted under 37 C.F.R. § 1.116(b). Alternatively, if these amendments are deemed to touch the merits, admission is requested under 37 C.F.R. § 1.116(c). In this connection, these amendments were not earlier presented because they are in response to the matters pointed out for the first time in the Final Office Action.

Lastly, admission is requested under 37 C.F.R. § 1.116(b) as presenting rejected claims in better form for consideration on appeal.

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance. Reexamination and reconsideration of the application, as amended, are requested.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los

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Angeles, California telephone number (310) 785-4600 to discuss the steps necessary for placing the application in condition for allowance.

If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-1314.

Respectfully submitted,
HOGAN & HARTSON L.L.P.

Date: June 30, 2008

By:



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